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RAC 1178
5 February 1963

HISTORY AND DESCRIPTION OF
MARINE CORPS BATTALION
LANDING TEAM AERIAL
DRONE RECONNAISSANCE SYSTEM(U)

AAS 274-806

Address inquiries concerning this document to:

Director Advanced Aircraft Systems
Republic Aviation Corporation
Farmingdale, L.I., N.Y.

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Material in this group is completely excluded from the automatic downgrading and automatic declassification provisions of this appendix.

1. Definition. Specifically, Group 1 material is that:
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GROUP 3 MATERIAL

Material in this group contains certain types of information or subject matter which warrant some degree of classification for an indefinite period.

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 - b. Intelligence and counter intelligence documents, including but not limited to:
 - (1) Intelligence estimates, except those contained in operations plans and orders of an Army Division, Navy Task Force, numbered Air Force, or other military command of comparable or lower level.
 - (2) Plans, directives, and reports regarding intelligence and counter intelligence operations; intelligence photography (aerial and ground); reports of intelligence and counter intelligence investigations; and detailed reports on friendly and enemy personnel who escaped or evaded capture.
 - (3) Documents containing information concerning special equipment or material for intelligence collection and counter-intelligence activities.
 - c. Radar and aerial photography.
 - d. Documents containing information concerning electronic countermeasures or counter-countermeasures.
 - e. Documents containing structural or performance data concerning naval vessels or naval armament and equipment in current use or for future use, as follows:
 - (1) Armor or protective systems; war damage or damage control.
 - (2) Proximity fuzes and fire control systems having designations Mk 37 or numerically higher, including their associated computers, radar and gunner.
 - (3) Subsurface performance, tactics, countermeasures, counter-countermeasures, bathymetric data, and gravimetric data.
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 - (1) Originated before 1 January 1946 was downgraded to SECRET on 26 November 1958, whether or not the material has been so marked.
 - (2) Originated on or after 1 January 1946 will be automatically downgraded to SECRET 12 years from the date it was created or on 1 May 1961, whichever date is later.
 - (3) Downgraded to SECRET according to (1) or (2) above will be automatically downgraded to CONFIDENTIAL 25 years from the date it was created or on 1 May 1961, whichever date is later, and will remain CONFIDENTIAL.
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 - b. 1946 and Later Material. Group 4 material originated on or after 1 January 1946 is automatically downgraded and automatically declassified as follows. These actions will be effective on 1 May 1961 or on the anniversary specified, whichever date is later.
 - (1) TOP SECRET material will be automatically:
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 - (b) Downgraded to CONFIDENTIAL 6 years from the date it was created.
 - (c) Declassified 12 years from the date it was created.
 - (2) SECRET material will be automatically:
 - (a) Downgraded to CONFIDENTIAL 3 years from the date it was created.
 - (b) Declassified 12 years from the date it was created.
 - (3) CONFIDENTIAL material will be automatically declassified 12 years from the date it was created.

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I. INTRODUCTION

This is a brief summary of the concept for a Marine Corps battalion landing team aerial drone reconnaissance system, which was developed by Republic Aviation Corporation under Office of Naval Research contract Nonr 3250(00). The contract resulted from a recommendation by the director of the Marine Corps Landing Force Development Center that a short-range, simple, low-cost, light-weight reconnaissance system be developed that could be operated by two marines.

The contract, which began in June 1960, specified a feasibility study only. It was later amended to include the design, fabrication, and flight test of two research models of the proposed aircraft with a camera payload. Close liaison was maintained throughout the study between the Office of Naval Research, Marine Corps Headquarters, Quantico, and Republic Aviation Corporation to ensure that the system met Marine Corps requirements.

This first ONR contract was completed with the publication of the final report on 30 March 1962. In addition to the two drone aircraft that were built under contract, Republic fabricated five additional drones. A pneumatic, catapult-type launcher was also designed, fabricated, and tested. During development, the external configuration of the aircraft was not changed radically from the original design concept, but several structural and aerodynamic modifications were incorporated. Many successful flights have been made, excellent aerial photographs taken, and drones recovered undamaged repeatedly, by parachute.

An experimental flight test program lasting several months was conducted at Republic Field during the winter of 1962. This was followed by a successful flight demonstration in early April at Marine Corps Air Station, Quantico, Virginia. Testing of the pneumatic catapult launcher, including additional drone flights from it, took place at Republic during the summer.

In September 1962, a radar tracking flight test program was conducted at Marine Corps Base, Twentynine Palms, California. All previous flights had been made under visual control. The objective of this program, conducted under contract Nonr 3950(00), was to demonstrate that a ground operator could fly the drone beyond visual sight from a radar plotting board trace and digital altitude readout. In spite of the usual problems associated with a low-budget,

experimental program, radar tracking was accomplished successfully on one flight, demonstrating the feasibility of the proposed system. Several other long range flights under visual control were made.

In January 1963, Republic received another contract -- Nonr 4042(00) -- for further development of the aerial drone reconnaissance system, sponsored by the U.S. Marine Corps. The objectives are to refine the aerodynamics and stability of the drone through a wind tunnel test program, to improve the security and reliability of the radio command and control system, and to develop efficient operational procedures for the photographic mission. The contract will conclude with an evaluation by the Marine Corps of the photographic reconnaissance potential of the system under visual flight control conditions.

The following pages contain a brief description of the battalion landing team aerial drone reconnaissance system as recommended in the final report resulting from the original study contract.

II. SYSTEM DESCRIPTION

The aerial drone reconnaissance system consists basically of a small aircraft capable of carrying a 70-mm camera and a ground complex consisting of a launcher and track, command, and data processing equipment (Figure 1). The aircraft is 76 inches long, has a wing span of 96 inches, and weighs about 40 pounds at launch. It is powered by a two-cycle, two cylinder air cooled engine, developing 2.7 horse power (Figures 2 and 3).

The aircraft is carried partially disassembled in its case and can be assembled rapidly by attaching the propeller, the wings, and the tail surfaces. A pneumatic catapult launcher accelerates it to flying speed in a distance of 6 feet. After launch, the aircraft can climb at about 900 feet per minute to a maximum pressure altitude of 10,000 feet. Reconnaissance can be performed from 300 feet above the terrain to the aircraft ceiling. At 3000 feet above terrain with the normal 3-inch lens, a ground resolution of 1 foot can be obtained at a 2200-foot-square area per photograph. With the alternative, 1.5-inch lens at the same altitude, a ground resolution of 2 feet can be obtained of a 4200-foot-square area. The camera is operated by a radio command signal from the ground. The drone is recovered by parachute (Figure 4).

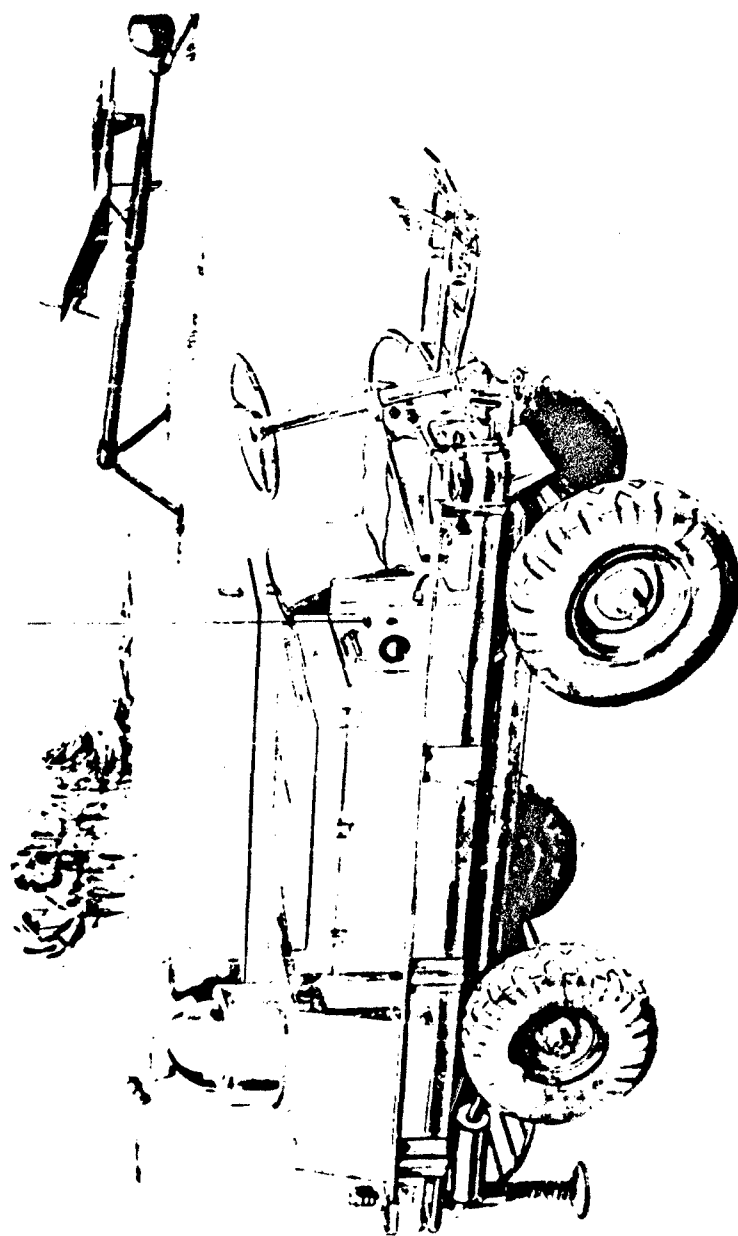


Figure 1. Reconnaissance System Complex

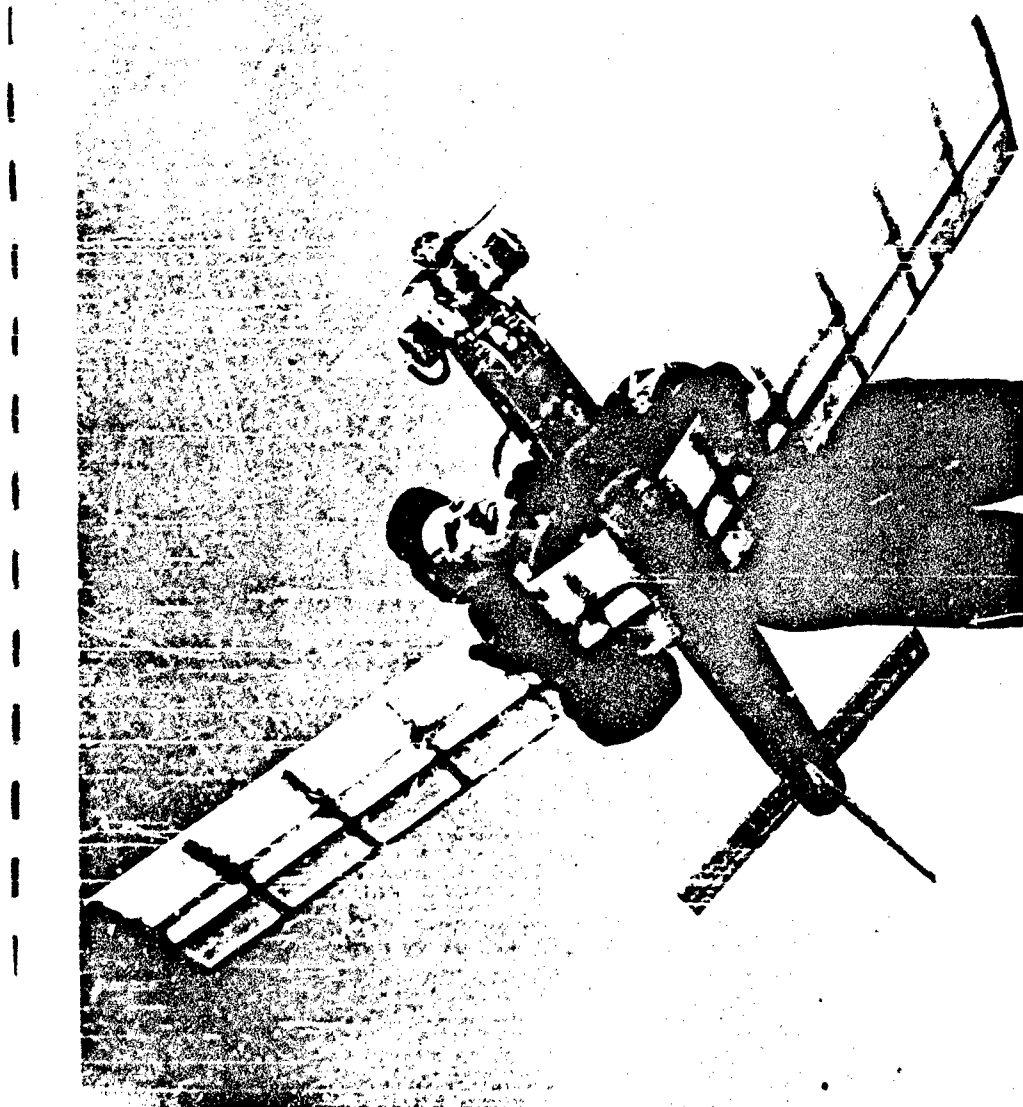


Figure 2. Reconnaissance Drone

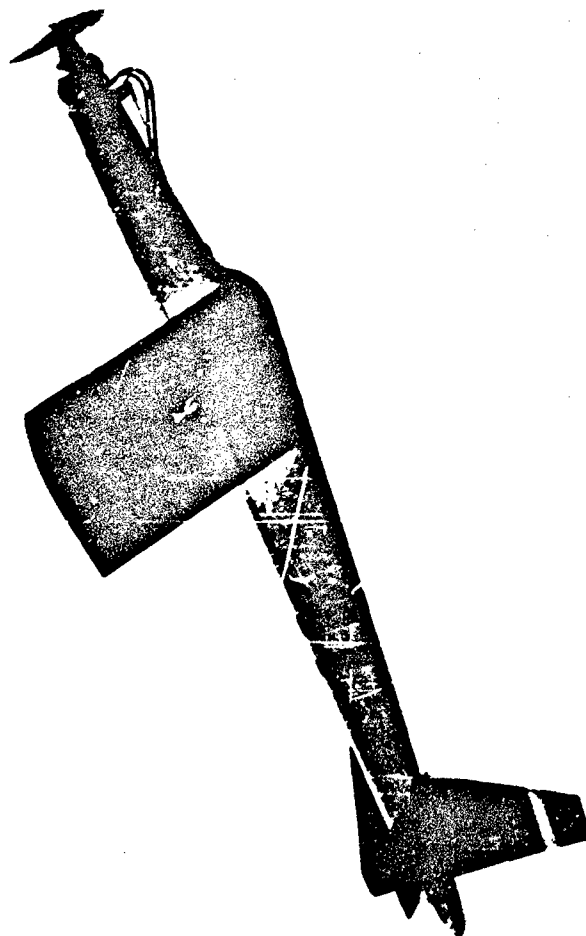


Figure 3. Drone in Flight

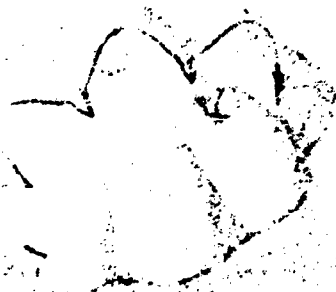


Figure 4. Drone Recovery

The drone, cruising at 60 to 80 miles per hour, has an endurance of about 45 minutes on 1 quart of automobile fuel. It can take 65 photographs (70-mm), which is a sufficient number to provide coverage along the entire length of the ground track when the 1.5-inch lens is used. There is no stable platform and no provision for image-motion compensation. High camera shutter speed (to 1/2000 second) prevents image-motion blur. Figure 5 is a photograph of Republic's airport taken from the drone.

In the system proposed as a result of the study contract, the drone is usually tracked by a lightweight, narrow-beam radar, which -- including plotter, tripod, and power supply -- weighs about 100 pounds. Because the drone is small and nearly transparent to radar, a small (1-pound) beacon is mounted in it to make it possible to track the drone to at least a 10-mile range. The aircraft is controlled by a semisecure radio link.

The system includes rapid film-processing equipment. The entire roll of film can be processed in about 2 minutes after the film magazine is removed from the camera. Negatives and positive transparencies can be produced. A printer-enlarger provides 9- by 9-inch prints.

The system has been designed for maximum flexibility in that the drone can be flown without radar tracking within the view of an observer using binoculars. The system has also been ruggedly designed to withstand normal handling by troops in the field.

When the drone is used with the proposed radar, a plot of drone position is automatically traced on the plotting board in real time. Altitude is automatically computed and shown numerically. The controller, through the radio command control system, corrects drone course for any deviations. This technique is considered to be more reliable and far more accurate than programmed guidance.

Among the features designed into the aerial drone reconnaissance system are the following:

- 1) The aircraft will be inexpensive in mass production
- 2) At photographic reconnaissance altitudes, the aircraft is nearly transparent to enemy radar, invulnerable to small-arms fire (because of speed, and small vulnerable area), and normally inaudible on the ground



Figure 5. Photograph Taken from Drone

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- 3) Night photography will be possible through the use of photoflash cartridges carried by the aircraft
- 4) Except for the radar, each piece of equipment weighs 50 pounds or less. The radar can readily be disassembled into two packages, each weighing 50 pounds. Therefore, the system can be carried by men
- 5) The entire ground system and three complete aircraft can be transported in one half-ton truck or in a jeep, with room for the two-man crew, their individual weapons, and voice radio
- 6) The aircraft is sufficiently rugged in construction to withstand being flown into a cargo net for shipboard recovery
- 7) The aircraft can carry many other payloads in addition to the normal camera payload. Possible alternative payloads are:
 - a) Radar ferret (used with photographic payload)
 - b) Television camera and transmitter
 - c) Extra fuel for extended range
 - d) High-priority cargo, such as medical supplies, captured documents, and photographs
 - e) Air-dropped packages, such as radiosondes, chemical, biological, and radiological analyzers, chaff, and smoke markers
 - f) Explosives
- 8) The engine is simply constructed and is highly reliable
- 9) A minimum of maintenance is required
- 10) The only expendable supplies required for system operation are fuel, film, processing chemical and paper, and photoflash cartridges for night photography

Performance and other data are given in Table 1.

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TABLE 1. PERFORMANCE AND OTHER DATA

Item	Characteristic
Weight, pounds	40
Speeds, miles per hour	
Cruise	60 to 80
Maximum	80 to 100
Launch	50
Sensor	P 2 camera
Altitude, feet above sea level	10,000
Recovery	Parachute
Operating crew	Two men
Transport	One jeep or mechanical mule
Wing span, inches	96
Length, inches	76
Launcher	Compressed-air catapult
Launcher weight, pounds	60
Engine	Two-cylinder, Two-cycle, 2.7 horsepower
Fuel	1 quart of regular automobile fuel
Starter	Pull-cord type

III TRAINING REQUIREMENTS

Throughout the feasibility study, the requirement of simplicity of equipment operation has been stressed. It is assumed that the operating personnel to be trained will be of average intelligence. Training will include indoctrination in the purpose, capabilities and limitations of the system; it will develop the skills required to maintain and operate the equipment.

The feasibility study suggests a list of qualifications for the selection of operating personnel and a training program requiring 150 hours during 19 day of indoctrination.